Nonadherence in asthmatic patients: is there a solution to the problem?
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Learning Objectives: Reading this article will reinforce the reader's awareness of the relationship between adherence and treatment outcome, of the causes of nonadherence, of methods of measurement, and of steps toward successful intervention.

Data Sources: Articles on adherence to asthma therapy were reviewed. A MEDLINE database using subject keywords was searched from 1990 through 1997.

Study Selection: Pertinent articles were chosen, with preferential presentation of results from controlled studies.

Results: There is no evidence of recent improvement in the rates of nonadherence, and patients continue on average to take about 50% of prescribed medication. Nonadherence assessment is most accurate when it can be measured objectively, and relies neither on patient report nor physician estimate. The consequences of nonadherence are measured in patient suffering, financial cost, and serious compromise of clinical trial outcomes. Underlying causes of nonadherence are traced to characteristics of the disease, treatment, patient, and caregiver system.

Conclusion: Improved adherence will lead to improved disease control, but only if medical care systems encourage and support the allocation of sufficient resources to allow barriers to self-management to be discussed and solutions negotiated. Attempts to improve adherence outside of the caregiver-patient relationship are less likely to succeed. Special programs for difficult-to-manage patients are necessary to change behavior, although significant illness improvement and cost savings are likely to result.


INTRODUCTION
That medication nonadherence is a common problem interfering with effective asthma management is well-established. Still, the extent, causes, and implications of nonadherence are not universally appreciated, and attempts to intervene have been at best only partially successful. This manuscript will discuss the relationship between adherence and treatment outcome and explore contributing factors and underlying causal mechanisms. Finally, methods for measuring and changing patient adherence behaviors will be discussed.

Adherence is the extent to which a patient follows a reasonable treatment plan that has been prescribed for them by a qualified caregiver. While intelligent nonadherence has been noted in cases where a treatment was detrimental to a patient who recognized this fact when his caregiver did not, the term adherence is adopted here with the understanding that most nonadherence undermines a patient’s health and well-being. To argue otherwise is to ignore overwhelming evidence. In a review of ten pediatric asthma adherence studies, medication adherence averaged 48%. Regardless of whether adherence is measured as serum theophylline levels at clinic visits, percent of prescribed medication taken, days of medication adherence, or percent of patients who fail to reach a clinically estimated adherence minimum, rates of nonadherence among asthmatic patients typically range from 30% to 70%.

Adherence must not be exclusively defined in reference to medication use. Patients who attempt to use their inhaled medication but do not adhere to good inhalation technique experience much less medication benefit. Current Guidelines for the Diagnosis and Management of Asthma conclude that control of severe asthma also depends upon peak flow meter use to monitor lung function, avoidance of allergens and irritants, and appropriate communication with the physician’s office. One study disclosed that patients failed to use their meter on 37% of days, while reporting such omission on their diary cards that nonuse occurred on only 7% of study days. Other behaviors that contribute to good health are important, although difficult to define and measure.

IMPACT OF NONADHERENCE
While a variety of solutions to patient nonadherence have been offered, their impact has been small and their employment limited to very few treatment settings. At present, evidence indicates...
that, overall, the problem of nonadherence to asthma treatment is not improving. The consequences of nonadherence continue to be measured in personal, financial, and research costs.

**Personal Cost**
While decreased adherence in some patients may not compromise disease control, the consequence of nonadherence for many patients is illness exacerbation. Children who did not adhere to therapy demonstrated significantly more wheezing, greater variability in peak flow rates, and lower asthma control scores, while adults whose airway obstruction failed to resolve were markedly less compliant than those who improved. More tragically, nonadherence has been associated with asthma-related deaths in children, particularly where psychologic dysfunction has been observed in the patient or the patient’s family.

Growing evidence reveals that many severely asthmatic patients are dramatically nonadherent. Across various chronic diseases, adherence improves as disease severity increases from mild to moderate, but appears to reverse with severe illness. Hospitalizations and emergency room visits, it might be assumed, would dramatically boost adherence motivation because they are frequently unpleasant and costly experiences that signal to patient and caregiver that a serious health decline has occurred. Strikingly, this assumption is frequently incorrect. Nonadherence is often high among patients who appear in the emergency room or hospital, and there is no evidence that such contacts with urgent care serve to increase and sustain subsequent adherence. Theophylline-treated asthmatic patients presenting at an emergency room have been found to have subtherapeutic theophylline levels. In a 90-day longitudinal study, eight children requiring urgent care visits resulting in oral steroid bursts (two of whom required subsequent hospitalization) had been dramatically less adherent with a daily regimen of inhaled steroids than a group of 16 patients with stable symptom control.

Perhaps the most revealing evidence regarding the consequences of nonadherence in severely asthmatic patients emerges from studies attempting to alter these patterns. A number of studies provided a psychoeducational intervention without altering availability or cost of medical care and medications. The degree to which the course of severe asthma was altered in these programs reflects the extent to which inadequate healthcare behavior contributes to poorly controlled asthma. Adult patients participating in a 7-week asthma self-management class were found to have significantly reduced asthma symptoms at 1-year follow-up. In another study, 104 adults with a history of asthma-related hospitalizations participated in a program emphasizing teaching patients self-management strategies in case of marked asthma exacerbation, resulting in a two-thirds reduction in readmissions.

**Financial Costs**
Asthma is a costly disease. The direct and indirect cost of asthma in 1990 was estimated to be $6.2 billion. The $3.6 billion direct medical costs included physician visits and medication, but the largest portion (almost $3 billion) resulted from emergency room visits and hospitalizations. Since only a small proportion of asthmatic patients will be hospitalized, much of the cost of asthma is created by a relatively small group of patients. Approximately 5% of asthmatic patients account for more than 70% of the total cost of asthma. Many of those asthmatic patients who present at the emergency room or hospital have been there before. That inadequate health care behavior results in increased cost is evidenced by the finding that a few programs targeting self-management behavior achieved significant subsequent savings through reduced hospitalizations and emergency room use.

**Clinical Investigation Costs**
Nonadherence in clinical trials can dilute treatment effects and result in erroneous conclusions. Just as in clinical practice, study patients are frequently nonadherent with their treatment. Clinical trial nonadherence can encompass a variety of behavioral absences, including failure to take study medication, failure to perform other protocol-dictated tasks such as completion of diary cards, and failure to attend study visits. Dropping out of a study is a relatively extreme act of nonadherence often preceded by medication nonadherence and sometimes resulting in distortion of outcome data. Study departure is an overt and obvious behavior that can be addressed in statistical analyses of outcome data.

Other forms of nonadherence, such as recording of fabricated data on diary cards, are much more difficult to recognize and therefore have potential for corrupting the study. One longitudinal study of the treatment of chronic obstructive lung disease disclosed that in an apparent attempt to conceal nonadherence 14% of participants were “dumping” large amounts of aerosolized medication shortly before scheduled visits while reporting adherence on their diary cards.

If undetected nonadherence significantly reduces drug use in a trial, the reported effectiveness of the trial medication will be seriously diluted and may result in unnecessarily high recommended doses. Ironically, adherent patients may consequently have increased exposure to potential side effects. If adherence rates differ for two equally effective drugs, the investigators may erroneously ascribe to pharmaceutical superiority a clinical difference partially or completely due to behavioral differences between study groups. Without sufficient monitoring of adherence, clinical trial results continue to be based upon inappropriate averages of adherence and fail to take advantage of the opportunity to increase insight into dose-response relationships introduced by varying levels of adherence.
CORRELATES OF NONADHERENCE

The causes of nonadherence are many but generally fall into one of three categories.

Disease and Treatment-Related Factors

Patients are less likely to adhere to their treatment regimen if their disease is either mild or severe, a troubling finding particularly in the case of patients with poorly controlled asthma. Adherence is further undermined in the presence of chronic illness requiring prolonged treatment, where the prescribed medications are used prophylactically, and where the consequences of cessation of treatment are delayed. Medication expense and side effects often deter patients. When medications are difficult to take, adherence declines; one study of inhaled medication use in asthmatic children disclosed 71% adherence with twice-daily dosing, decreasing to 34% with three-times-a-day and 18% with four-times-a-day dosing; however, other studies have not replicated this dose-response pattern of adherence. Still, simplification of the treatment regimen tends to foster improved adherence. Once daily dosing with theophylline tablets resulted in dramatically higher adherence rates than twice daily use of inhaled corticosteroids or cromolyn sodium in asthmatic adolescents and adults. Some patients simply do not like taking inhaled medications, and many fail to master the necessary skill required for effective actuation-to-inhalation coordination required with these drugs. Unfortunately, most of these factors, including long-term treatment, delayed cessation of treatment consequence, expense, side effects, skill requirements, and frequent dosing schedules, all characterize the treatment of significant asthma.

Patient-Related Factors

Many patients are nonadherent, and no simple profile characterizes all or even most nonadherent patients. Failure to adhere to treatment regimen can be found in patients of varying demographic, psychologic, or illness profiles. Some patient characteristics, however, are correlated with medication adherence, indicating the existence of specific subgroups of nonadherent patients. Not surprisingly, reduced intelligence has been associated with poor adherence. Increased age, on the other hand, has not; while elderly individuals might be expected to have difficulty tracking and remembering their medication regimen, most studies have failed to disclose reduced adherence in this population relative to younger adults.

Psychopathology is the clearest patient characteristic associated with medication nonadherence. Decreased capacity to maintain a consistent regimen of disease self-management is evident in not only psychiatrically disturbed individuals, but also dysfunctional families. Distressed or psychologically unstable parents may not provide the structure and support necessary to ensure adherence of their children. In many such cases, children are given inappropriate responsibility for their own medical care; when parents are not committed to following a prescribed asthma management program, it is unrealistic to expect good adherence from the child.

Serious psychologic disorder can result in denial and create a particularly dangerous situation. A pattern of poor self-management and significant psychologic dysfunction in patients and their families has been identified in children and adolescents who died of asthma. A history of erratic asthma management, conflict between parent and child, frequent changes of health care provider, and child depression or anger are signals that standard medical care alone cannot adequately address nonadherence. Depression and loss of faith in the value of therapy are common in patients who willfully fail to comply and manipulate their asthma for secondary gain.

Even in the absence of psychologic dysfunction, adherence is largely mediated by the psychologic outlook of the patient or the patient’s parents. The Health Belief Model was formulated to explain how a patient’s experiences, perceptions, and beliefs guide their understanding of, and response to, their disease. The Health Belief Model holds that patients frequently conduct their own cost-benefit analysis with regard to treatments proposed by their health care provider. Patients are more likely to adhere to a prescribed treatment if they believe their illness as significant, and if they believe that the proposed treatment will be effective without adverse consequence such as medication side effects, financial sacrifice, or lifestyle change. These beliefs are greatly affected by the patient’s experiences and information obtained from acquaintances and the public media. Awareness of controversies surrounding first-line asthma therapies—corticosteroids, theophylline, and, most recently, beta-agonists—contribute to reluctance and increase nonadherence. Failure of one therapy to effectively manage symptoms may create skepticism toward successive therapies. Patients commonly consult more than one caregiver for their asthma; lack of agreement between caregivers further undermines the belief that the effort, cost, and inconvenience of asthma treatment are justified. Once established, health beliefs are not easily altered. If a patient’s asthma is misdiagnosed, initial treatments are ineffective, and education about the disease is incomplete or inaccurate, the consequent health beliefs formulated by the patient will create a barrier to subsequent effective disease management.

Conversely, a positive orientation toward health not only strengthens medication adherence but also leads to other important if difficult-to-measure health behaviors. Evidence for the contribution of positive health care behavior, aside from medication usage, is seen in a study of almost 4000 patients who had experienced myocardial infarction. The 5-year mortality rate of those treated with active clofibrate (18.2%) was only slightly better than that of patients treated with placebo (19.4%). Of greater interest was the finding that patients with high adher-
ence rates in both groups had a dramatically lower mortality rate than poor adherers. That high adherence to placebo yielded a better survival rate (85%) than low adherence (72%) likely reflected a difference in outlook and healthcare behavior between high and low adherers. More specifically, high medication adherers are also likely to exercise, change diet, and move in the direction of improved health more readily than low adherers. The expectation that one’s own behavior can and will lead to improved health is a key determinant of both adherence and positive clinical outcome.

Caregiver-Related Factors
The caregiver-patient relationship remains a primary determinant of treatment adherence. Patients who like and trust their caregiver trust the treatments they prescribe. Such trust is promoted by caregivers who are warm, friendly, and approachable; provide information and encourage communication; and allow their patient a sense of control within the relationship and with regard to the treatment plan. The caregiver’s willingness to spend time with a patient, listen to his or her concerns, and attempt to understand their perceptions and belief about the illness and its treatment is a positive indicator of commitment to changing health beliefs and behavior.32,33

METHODS FOR MEASURING PATIENT ADHERENCE
In order to identify adherence difficulties accurately or to develop effective adherence-promoting strategies, patient adherence behavior must be measured. The best measurement strategy for assessing adherence will be based on the level of precision required by the clinician or researcher’s goals. A broadly defined, flexible criterion of acceptable adherence may not need precise measurement methodology. When detailed and exact adherence data are necessary (as in research), however, the measurement strategies should be comparably precise. The most common measures used to assess patient adherence with asthma therapy are biochemical measurement, clinical judgement, self-report, medication measurement, pharmacy data base review, and electronic measurement.37–39

Biochemical Measurement
Inhaled medications are not easily detectable by biochemical assays because of the rapid and limited systemic absorption of these agents. For this reason, theophylline is the only asthma medication adherence that is commonly measured by biochemical assay. Since assays of theophylline are routinely measured as a part of clinical care to determine whether a therapeutic level of theophylline has been achieved, the clinician or researcher can be provided with ongoing information about patient adherence levels. Biochemical measurement is the only adherence measurement strategy that provides direct confirmation of drug use; however, these measures have several limitations. Conclusions drawn from biochemical measures can be confounded by diet and/or other drug use (e.g., the effect of smoking on theophylline), and these measures cannot be used to measure day-to-day patterns of adherence with therapy. Finally, biochemical measurements can be compromised if patients deliberately, or inadvertently, begin taking medications just before clinical samples are collected.40–46

Clinical Judgement
In everyday clinical care, healthcare providers form impressions of how well each patient is following the prescribed regimen. These clinical evaluations of patient adherence will shape the content of the patient-provider interaction, the selected therapy, and the follow-up plan. Several classic studies have shown, however, that physicians generally greatly overestimate the degree to which their patients comply with their directives. The lack of physician accuracy in identifying patients with adherence difficulties has been attributed to a medical education focus that neglects communication skills and attention to psychosocial issues. Clinical judgement based on preconceived beliefs about the attributes of the “typical” compliant patient are destined to fail. Patient characteristics such as race, education, sex, socioeconomic status, and personality have not been found to be reliable predictors of adherence. Physician interviewing skills and the qualities of the patient-provider interaction will be more important in both measuring and facilitating adherence than stereotypical beliefs about adherence.47–49

Self-Report
Patient self-report of medication use is a standard measure of adherence in both clinical trials and behavioral intervention studies. Self-reports may be collected by interview, diaries, and questionnaires. No validated adherence-specific questionnaire is currently in common use, in part because most self-report questionnaires of adherence have been designed for specific studies. Self-report measures are common because they are simple, inexpensive, and generally brief. In addition, self-report (particularly in the clinical setting) is the best measure for collecting information about patient beliefs, attitudes, and experiences with medication regimens.

As a quantitative measure of medication use, self-report has been found to have a highly variable degree of accuracy. Studies by Spector et al, Coutts et al, and Gibson et al have compared asthmatic patients’ self-reports of inhaler usage with the objective adherence data collected by an electronic medication monitoring device.41,44,50 These studies have all indicated that patient self-reports of adherence recorded in asthma diaries typically overestimate adherence.

Self-reports of adherence will be influenced by the demand characteristics on the setting in which the information is collected. The desire to please the physician or investigator can lead patients to exaggerate reports of medication use. Physicians’ and investigators’ skills and sensitivity in eliciting patients’ self-reports will influence the reliability and usefulness of the infor-
mation they receive. While self-report may not be a sufficient measure of adherence in many settings and particularly in research, it is probably a necessary measure in all settings. When carefully collected, self-reported adherence information can provide critical insight into the nature of patients’ problems with adherence. In addition, because there is no evidence to suggest that adhering patients will misrepresent themselves as nonadherers, self-report measures will identify the honest nonadherers.24,50–52

Medication Measurement
Counting pills, checking prescription refills, or weighing inhaler canisters or liquid medication are examples of medication measurement, an objective measure that allows researchers to infer the degree of medication adherence. This method requires recording the exact quantity of medication issued to a patient and returned by the patient at follow-up. Level of adherence is calculated by deriving average daily usage over the monitored period. While medication measurement data are both objective and reasonably simple to collect, they are limited by several factors. Medication measures can be influenced by a patient’s efforts to deceive the investigator. Some patients may discard medication to appear adherent. Medications may be shared within households, particularly when family members are on the same medication. In addition, medication measures give no indication of the accuracy of dosages or the timing of the medication. In situations where patients are comfortable reporting nonadherence, the pattern of medication use is not critical; and where the likelihood of medication sharing is low, medication measurement is a useful, objective, and valid means of assessing adherence.53,54

Pharmacy Database-Review
In some managed care settings, pharmacy databases can provide information on the exact regimen prescribed, the amount of medication dispensed, and the timing of refills. These data can be used to roughly calculate the average dose per day. In some healthcare data management systems, prescriptions written but never filled also can be monitored. Dispensing data can also be matched with medical record and healthcare utilization databases to provide integrated analyses of the antecedents and consequences of patient adherence behaviors. Review of automated pharmacy records can also allow large-scale population studies of patient adherence with medication. Pharmacy database review to identify non-adherence has several limitations. First, adherence estimates can only be calculated for patients who exclusively rely on the target pharmacy system for all prescriptions and refills. Second, pharmacy data can determine when a prescription was filled; however, it provides no confirmation of consumption or appropriate consumption patterns. Nevertheless, as more pharmacy data go on-line, this adherence measuring strategy has great potential to evaluate the compliance of both individuals and clinical populations.55,56

Electronic Medication Monitors
In the past 10 years, the increased availability of computer-based technology has introduced a new strategy for adherence monitoring. Electronic monitoring devices record and store the date (and for some devices, time) of each medication use. Devices have been developed to monitor medication adherence behaviors including, but not restricted to, opening a pill bottle, releasing a blister-pale pill, discharging inhaled medications, and releasing eye drops. Two electronic devices that have been investigated in asthma management are the Nebulizer Chronolog (Medtrac Technologies, Inc, Lakewood, CO) and the Doser (NEWMED Corp, Newton, MA). The Nebulizer Chronolog is an electronic device that attaches to a metered dose inhaler (MDI) and records each use of the MDI. The Nebulizer Chronolog unit stores the date and time for each actuation and can store up to 2000 events over several months. Chronolog data can be directly downloaded into a PC. The newest version of the device (under development) will be called the Medilog. The less expensive Doser device is an electronic cap that records and displays daily uses of an inhaler, as well as remaining doses in an MDI canister. The Doser maintains a record of use for the past 30 days; however, this device does not record time of use. In addition, the Doser cannot be directly downloaded to a PC.

In recent years, the number of published studies that have used electronic adherence monitoring devices has dramatically increased. While neither the Nebulizer Chronolog nor the Doser provides actual data on medication use, they provide a unique opportunity to investigate long-term patterns of presumptive adherence which were heretofore unavailable in such detail. The primary benefit of this type of monitoring is clear—electronic monitoring methods can provide a continuous record of timing of presumptive doses over periods of months.

Evaluations of adherence made by provider, self-report, pill counts, or canister weights can be inaccurate because of recall, demand characteristics, deception, and provider biases. These methods are also insensitive to daily patterns of use over time. The phenomenon of medication “dumping” is nearly impossible to detect by traditional methods of adherence assessment, and inclusion of dumping data into a dose-response analysis can yield counterintuitive results; highly adherent subjects show poorer response than moderately adherent subjects. This phenomenon is likely to be present in any situation in which medication use is being monitored and should be taken into consideration when making medication recommendations.

While electronic measures of adherence have a number of unique strengths, they also have a number of weaknesses. The cost for wide-scale use can be prohibitive for a small practice and may only be feasible in a clinical trial setting. Additionally, failure rate associated with the use of any type of electronic device may be unacceptable. The failure rate in electronic devices can be caused by patient mis-
use, device failure, or computer hardware/software problems. For these reasons, clinicians or researchers who use such devices must be careful to develop quality control procedures that ensure the ongoing monitoring of device performance and validity.  

IMPROVING ADHERENCE

What Caregivers Can Do

That improving treatment adherence can lead to better asthma control has been widely addressed.  

Recent discussions have increasingly recognized that the cost of introducing programs to better educate asthmatic patients in self-management knowledge and skills may be offset multifold by savings realized when patients require less emergent care and fewer hospitalizations. The more difficult task of changing patient behavior requires greater awareness of patients’ individual perceptions of their disease and its treatment, and increased commitment from the health care provider to communicate with and teach patients. The new Guidelines for the Diagnosis and Management of Asthma address more comprehensively the caregiver’s role in assessing patient perceptions, emphasizing the need for a “partnership” between caregiver and patient to improve treatment adherence and disease outcome.

The relationship between patient and caregiver is the single most powerful tool for changing patient health care behavior. Other attempts to improve adherence are unlikely to succeed if the patient does not like and trust his or her doctor. Patients will not reveal concerns about their illness or reluctance about a proposed treatment if they believe that the caregiver is hurried, disinterested, or, worse yet, will become impatient or annoyed. The caregiver may say the right words—“Hello, how are you doing today?”—but simultaneously convey a nonverbal message that they are rushed and do not wish to be bothered by excessive conversation. Making direct eye contact, transmitting genuine interest in what the patient has to say, explaining all recommendations thoroughly and in clear language, praising good treatment adherence and problem solving, and expressing willingness to modify the treatment plan in accord with concerns expressed by the patient all enhance adherence. Once a positive relationship is established, other adherence-improving changes may be negotiated, including prescribing medications that are less costly or which avoid side effects concerning to the patient, finding reminders to help patients remember when to take a medication, changing dosing schedules to accommodate a patient’s work schedule, and reducing the number of medications.

The Guidelines for the Diagnosis and Management of Asthma further recommend that caregivers themselves provide patient education at the time of diagnosis; that they repeatedly reinforce the patient’s knowledge and skills; that they give the patient a written, individualized treatment plan; and that they remain sensitive and responsive to patient cultural and language differences. The Guidelines additionally provide examples of specific questions to be used by the caregiver at patient visits to better address patient beliefs and perceptions.

Changing Behavior of “Difficult” Patients

A subgroup of patients may be particularly burdensome for the health care provider. They take extra time, create stress and sometimes financial cost for the provider, and are frequently experienced as treatment failures. Many are patients with psychologic dysfunctions that make them difficult to manage because they resist or are in direct conflict with the caregiver, frequently complain, use multiple caregivers or switch caregivers frequently, miss appointments, and are inconsistent in their treatment adherence. Other life stresses—including poverty, loss of a job, being the victim of a crime—only add to this picture of disorganization, conflict, and poor illness management. In such cases, the absence of an appropriate response to symptom deterioration serves to continue a pattern of repeated emergency room visits and hospitalizations without improved adherence or asthma improvement and resulting, in the worst cases, in death. The cost of this pattern can be measured both in terms of human suffering and increased health expense. This group of difficult-to-manage patients is well-represented in the small proportion of asthmatic patients who account for a large portion of the annual cost of caring for asthma.

Changing self-care behavior in this group requires a more intensive and individualized intervention program than is necessary for the general patient population. Positive caregiver communication and recurrent education remain the cornerstones of adherence-promoting health care. Successful intervention with this group of difficult, adherence-resistant patients, however, is more likely to be achieved with the presence of an additional member of the healthcare team charged with the specific responsibility of individualizing care for these patients.

This approach is exemplified by a pilot investigation at the Harvard Pilgrim Health Care health maintenance organization in New England, where an Asthma Outreach Program targeted asthmatic children of high risk families identified initially by use of the emergency room or hospital admission for asthma. The intervention consisted primarily of increased contact with an outreach clinician, an allergy nurse practitioner who met individually with families, provided an individualized education program and treatment plan, maintained weekly or bimonthly telephone contact, and in some cases visited families in their homes. At the study’s end, the children’s asthma was significantly improved, as evidenced by a 79% reduction in emergency room visits and 86% reduction in hospital admissions.
In some cases, referral for psychologic services may be necessary before improvement in health care behavior can be effected. For example, families in which conflict and parental psychopathology prevent adequate care for the asthmatic child will benefit from behaviorally focused family therapy.31 Such services are most likely to be helpful when provided by a mental health professional knowledgeable about asthma and working in communication with the health care provider.32,33 The Guidelines for the Diagnosis and Management of Asthma7 recommend the enlistment of family support for asthmatic patients having difficulty with self-management, and recommend referral to a psychologist, social worker, psychiatrist, or other licensed professional when emotional or social stress confound the patient’s struggle with asthma control.

Programmatic Support
Caregiver-based efforts to improve health are unlikely to be effective without the authority and support of the healthcare organization. This is of particular concern where attempts to increase efficiency lead to decreased frequency and duration of patient contact with doctors and nurses. Healthcare providers compelled to spend less time with more patients will be hard-pressed to develop the personal relationships necessary to enhance adherence. Measures that appear to save money may do the reverse by creating a system that discourages patient adherence.62 Planning efficient and effective healthcare must take into consideration the importance and allocates sufficient resources to ensure their success.

planned well, their additional expense will be offset by savings achieved when increased adherence results in decreased emergency room use and hospitalizations.

CONCLUSIONS
Despite growing awareness of the importance of patient education, adherence to asthma treatment shows no sign of improvement. On average, patients continue to take only about half of their medication. Adherence to other healthcare behaviors important to the management of asthma, including use of peak flow meters and avoidance of environmental irritants, also appear to be poor, although objective data about these behaviors are limited. The relationship between patient and healthcare provider is central to the task of improving adherence. Educating physicians about patient adherence and supporting their efforts to discuss and negotiate treatment is the most promising avenue toward better asthma self-management. Many specific techniques of adherence intervention, such as decreasing the number of medications or encouraging the use of medication reminders, are unlikely to change behavior unless they are discussed within this relationship and stem from the trust of the patient in his/her physician. This concept is endorsed by the new Expert Guidelines, which emphasize the importance of a caregiver-patient partnership and the inclusion of the caregiver in ongoing patient education. For difficult-to-manage patients, increased resources must be allocated toward more intensive adherence intervention efforts. The effectiveness of such a program is likely to be seen in improved health and decreased treatment costs, particularly in terms of emergency room visits and hospitalizations. The impact of such efforts will occur only when the healthcare system recognizes their importance and allocates sufficient resources to ensure their success.

REFERENCES
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CME Examination
No 017-009

CME Test Questions

1. The term adherence refers to
   a. a patient’s willingness to follow a doctor’s instructions blindly.
   b. only medication use.
   c. the extent to which a patient will follow a reasonable treatment plan.
   d. the degree to which a physician follows expert guidelines.
   e. all of the above.

2. Which of the following is NOT true
   a. Patients with psychological dysfunction tend to be nonadherent.
   b. Patient education usually improves patient adherence dramatically.
   c. Patients who go to the emergency room for asthma care are frequently nonadherent.
   d. The patient-caregiver relationship is the single most important actor influencing adherence.
   e. all of the above.

3. The adherence of patients with severe asthma is ________ that of patients with mild disease
   a. greater than
   b. same as
   c. more predictable than
   d. more variable than
   e. less than

4. 70% of the cost associated with asthma is incurred by what proportion of patients:
   a. 5%
   b. 50%
   c. 55%
   d. 43%
   e. 25%

5. The effect of unrecognized nonadherence in clinical trials is
   a. to decrease reported effectiveness of a drug.
   b. to lead investigators to recommend unnecessarily high dosages.
   c. to increase exposure to side effects among adherent patients.
   d. to obscure understanding of dose-response relationships.
   e. all of the above.

6. If nonadherence is suspected in a patient whose asthma is not well controlled, the physician should
   a. increase the frequency of doses.
   b. give the patient the benefit of the doubt if he or she states that they are adherent.
   c. switch to a medication that is easier to take.
   d. attempt to increase communication with the patient about his use of the prescribed medication.
   e. refer the patient to a psychologist.

7. Most patients who are nonadherent are
   a. young.
   b. emotionally disturbed.
   c. male.
   d. less well educated.
   e. none of the above.

8. Which of the following statements is NOT true?
   a. Psychological dysfunction is one of the strongest predictors of nonadherence.

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b. Patients’ health beliefs are mostly the result of what they are told by their physician.

c. Patients who adhere to their treatment plan are likely engaged in other behaviors that contribute to health.

d. Patients are more likely to be adherent if their caregiver is warm and friendly.

9. Which of the following family characteristics was NOT associated with asthma-related death:

a. medication nonadherence
b. frequent change in health care provider
c. history of conflict between parent and child
d. low parent education level
e. history of child depression or anger

10. Biochemical assays have been most frequently used to detect adherence with:

a. inhaled corticosteroids.
b. oral corticosteroids.
c. beta agonist.
d. theophylline.
e. cromolyn sodium.

11. Direct measurement of returned medication as an index of adherence in clinical trials has been confounded frequently by:

a. patient “dumping” of medication.
b. hiding of the medication by other family members.
c. incorrect study dispensing records.
d. pharmacy errors.
e. all of the above.

12. Across studies, asthmatic patients on average take about how much of their prescribed medication?

a. 30%
b. 40%
c. 50%
d. 60%
e. 70%

13. Electronic monitoring of medication adherence provides a strong advantage in evaluating medication adherence because:

a. it can detect patients who spit out their medication.
b. it can reveal patterns of medication use by recording both date and time of use.
c. it is error free.
d. it costs very little.
e. it cannot be deceived by patients.

14. Caregivers can increase patient adherence by:

a. demonstrating unhurried interest and concern.
b. explaining the treatment plan in detail.
c. providing written instruction.
d. demonstrating sensitivity to cultural and language differences.
e. all of the above.

15. In considering adherence by patients with asthma the physician must consider:

a. peak flow meter use.
b. smoking.
c. keeping appointments.
d. medication.
e. all of the above.

16. Reported consequences of nonadherence include:

a. exacerbation of illness.
b. increased symptoms.
c. greater variability in peak flow rates.
d. deaths in children.
e. all of the above.

17. Which of the following causes the least detriment to the interpretation of study data?

a. nonadherence with study medication.
b. dropping out of a study.
c. fabricated data.
d. “dumping” of medication.
e. nonadherence with study visits.

18. Which of the following is the least reliable measure to assess patient adherence with asthma therapy?

a. biochemical measurement.
b. clinical judgement.
c. medication measurement.
d. pharmacy data base review.
e. electronic measurement.

19. Which statement about measuring drug concentrations in the blood is not true?

a. It can be confounded by diet.
b. It can be confounded by other drug use.
c. It can be compromised if patients take medicine at the wrong time.
d. It can be used with confidence for most asthma medications.
e. It generally cannot be used to measure day-to-day patterns.

20. Which statement about patient self-report of medication use is not true?

a. Accurate, validated adherence-determining questionnaires are available for common use.
b. Patient self-report of medication use is a standard measure of adherence in both clinical trials and behavioral intervention studies.
c. Self-reports may be collected by interview, diaries, and questionnaires.
d. Self-report measures are common because they are simple, inexpensive, and generally brief.
e. Self-report is the best measure for collecting information about patient beliefs, attitudes, and experiences with medication regimens.

21. Patients are more likely to adhere if they believe that:

a. the therapy is effective.
b. the illness is significant.
c. the treatment will have minimal side-effects.
d. the treatment will require few lifestyle changes.
e. all of the above.

22. Studies have shown that physicians generally:

a. underestimate adherence.
b. overestimate adherence.
c. accurately assess patient adherence.
d. can use patient characteristics, such as education level, to accurately assess adherence.

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